WHAT IS CLAIMED IS:

1. A method for electrochemical placement of a material at a specific location on a substrate, which comprises the steps of:

providing a substrate having at its surface at least one electrode that is proximate to at least one molecule bearing at least one protected chemical functional group,

applying a potential to said electrode sufficient to generate electrochemical reagents capable of deprotecting at least one of the protected chemical functional groups of said molecule, and

bonding the deprotected chemical functional group with a monomer or a pre-formed molecule.

2. A method according to claim 1, further comprising placing a buffering or scavenging solution in contact with the electrode at the surface of the substrate to prevent the electrochemically generated reagents from leaving the locality of the electrode.

3. A method according to claim 2, wherein said buffering solution is selected from acetate buffers, borate buffers, carbonate buffers, citrate buffers, glycine buffers, HEPES buffers, MOPS buffers, phosphate buffers, TRIS buffers and KI solutions.

4. A method according to claim 2, wherein said buffering solution is present in a concentration of at least 0.01 mM.

5. A method according to claim 2, wherein the concentration of the buffering solution ranges from 0.1 to 100 mM.

6. A method according to claim 1, wherein said monomer or preformed molecule has at least one other protected chemical functional group at a site different from where bonding with the deprotected chemical functional group of the molecule occurs.

7. A method according to claim 1, wherein said monomer is an amino acid.

8. A method according to claim 1, wherein said pre-formed molecule is selected from proteins, nucleic acids, polysaccharides, and porphyrins.

9. A method according to claim 1, wherein said molecule is a linker molecule or a monomer.

10. A method according to claim 1, wherein said molecule is a linker molecule or a monomer.

11. A method according to claim 1, wherein said molecule is directly attached to the surface of said substrate, is attached to the surface of said substrate via a linker molecule, or is attached to a layer of material overlaying said substrate.

12. A method according to claim 1, wherein said protected chemical functional groups are protected with an acid or base labile protecting group.

13. A method according to claim 1, wherein said at least one electrode comprises an array of electrodes.

14. A method according to claim 13, wherein said array of electrodes comprises at least 100 electrodes.

15. A method according to claim 6, further comprising sequentially deprotecting the other protected chemical functional group of the monomer or pre- formed molecule and bonding to the deprotected monomer or pre-formed molecule another monomer or pre-formed molecule.

16. A method for electrochemical synthesis of an array of separately formed polymers on a substrate, which comprises the steps of:

placing a buffering or scavenging solution in contact with an array of electrodes that is proximate to a substrate surface, said surface being proximate to one or more molecules bearing at least one protected chemical functional group attached thereto,

selectively deprotecting at least one protected chemical functional group on at least one of said molecules;

bonding a first monomer having at least one protected chemical functional group to one or more deprotected chemical functional groups of said molecule;

selectively deprotecting a chemical functional group on the bonded molecule or another of said molecules bearing at least one protected chemical functional group;

bonding a second monomer having at least one protected chemical functional group to a deprotected chemical functional group of the bonded molecule or said other deprotected molecule; and

repeating the selective deprotection of a chemical functional group on a bonded protected monomer or a bonded protected molecule and the subsequent bonding of an additional monomer to said deprotected chemical functional group until at least two separate polymers of desired length are formed on the substrate surface.

16 ~~17~~. A method according to claim 15 ~~16~~, wherein during said selective deprotection steps, an electric potential is applied to one or more selected electrodes sufficient to generate electrochemical reagents at the selected electrodes capable of deprotecting the chemical functional groups on said proximate molecules or monomers.

17 ~~18~~. A method according to claim 15 ~~16~~, wherein said buffering or scavenging solution prevents the electrochemical reagents generated at selected electrodes from deprotecting the chemical functional groups of molecules or monomers proximate to unselected electrodes.

18 ~~19~~. A method according to claim 15 ~~16~~, wherein said buffering solution is selected from acetate buffers, borate buffers, carbonate buffers, citrate buffers, glycine buffers, HEPES buffers, MOPS buffers, phosphate buffers, TRIS buffers and KI solutions.

20. A method according to claim 16, wherein said buffering solution is present in a concentration of at least 0.01 mM.

21. A method according to claim 16, wherein the concentration of the buffering solution ranges from 0.1 to 100 mM.

22. A method according to claim 16, wherein said monomers are amino acids.

23. A method according to claim 16, wherein said molecules are linker molecules or monomers.

24. A method according to claim 16, wherein said molecules are directly attached to the substrate surface, are attached to the substrate surface via a linker molecule, or are attached to a layer of material overlaying said substrate surface.

25. A method according to claim 24, wherein said overlaying layer is controlled porosity glass.

26. A method according to claim 23, wherein said linker molecule comprises a group cleavable by an electrochemically generated reagent, which cleavable group enables removal from said substrate of one or more bonded molecules.

27. A method according to claim 16, wherein said protected chemical functional groups are protected with an acid or base labile protecting group.

28. A method according to claim 16, wherein said substrate is formed from at least one material selected from undoped semiconductors, glass, ceramics, polymers, and waxes.

29. A method according to claim 16, wherein said array of electrodes comprises at least 100 electrodes.

30. A method according to claim 16, wherein said array of electrodes comprises a matrix having at least 2048 electrodes.

31. A method according to claim 30, wherein said array of electrodes comprises a matrix having at least 204,800 electrodes.

32. A method according to claim 16, wherein each of the electrodes in said array ranges in diameter from less than 1 micron to about 100 microns.

33. A method according to claim 16, wherein the electrodes of said array are formed from platinum or palladium.

34. A method according to claim 33, wherein said platinum or palladium electrodes are preloaded with hydrogen.

35. A method according to claim 16, which further comprises a capping step wherein unbonded deprotected chemical functional groups on said molecules or monomers are capped with acetic anhydride or n-methylimidizole.

36. A method according to claim 16, which further comprises an additional bonding step wherein a pre-formed molecule is bonded to a deprotected chemical functional group on one or more of said molecules or monomers.

37. A method according to claim 36, wherein said pre-formed molecule is selected from proteins, nucleic acids, polysaccharides, and porphyrins.

38. A method according to claim 36, wherein said pre-formed molecule bears at least one protected chemical functional group to which an additional monomer may bond following selective deprotection of the chemical functional group on the pre- formed molecule.

39. A method according to claim 17, wherein the one or more selected electrodes to which an electric potential is applied are selected by at a switching mechanism selected from CMOS switching circuitry, radio frequency addressable switches, microwave frequency addressable switches and light addressable switches.

40. A method according to claim 16, wherein said array of electrodes comprises at least 1024 electrodes.

41. A method for electrochemical synthesis of an array of separately formed oligonucleotides on a substrate, which comprises the steps of:

placing a buffering or scavenging solution in contact with an array of electrodes that is proximate to a substrate surface, said surface being proximate to one or more molecules bearing at least one protected chemical functional group attached thereto,

selectively deprotecting at least one protected chemical functional group on at least one of said molecules; bonding a first nucleotide having at least one protected chemical functional group;

bonding a second nucleotide having at least one protected chemical functional group to a deprotected chemical functional group of the nucleotide bonded molecule or said other deprotected molecule; and

repeating the selective deprotection of a chemical functional group on a protected bonded nucleotide or a protected bonded molecule and the subsequent bonding of an additional nucleotide to said deprotected chemical functional group until at least two separate oligonucleotides of desired length are formed on the substrate surface.

42. A method according to claim 41, wherein during said selective deprotection steps, an electric potential is applied to one or more selected electrodes sufficient to generate electrochemical reagents at the selected electrodes capable of deprotecting the chemical functional groups on said proximate molecules or nucleic acids.

43. A method according to claim 41, wherein said buffering or scavenging solution prevents the electrochemical reagents generated at selected electrodes from deprotecting the chemical functional groups of molecules or nucleotides proximate to unselected electrodes.

44. A method according to claim 8, wherein said pre-formed molecule is a nucleic acid.

45. A method according to claim 41 wherein a "getter" structure is situated proximate to one or more of said electrodes.

46. A method according to claim 45 wherein said "getter" structure is a second substantially ring-shaped electrode.

47. A method for electrochemical placement of a material at a specific location on a substrate, which comprises the steps of:

providing a substrate having at its surface at least one electrode that is proximate to at least one molecule that is reactive with an electrochemically generated reagent,

applying a potential to the electrode sufficient to generate electrochemical reagents capable of reacting to the at least one molecule proximate to the electrode, and

producing a chemical reaction thereby.

48. A method according to claim 47, further comprising placing a buffering or scavenging solution in contact with the electrode at the surface of the substrate to prevent the electrochemically generated reagents from leaving the locality of the electrode.

49. A method according to claim 48, wherein said buffering solution is selected from acetate buffers, borate buffers, carbonate buffers, citrate buffers, glycine buffers, HEPES buffers, MOPS buffers, phosphate buffers, TRIS buffers and KI solutions.

50. A method according to claim 48, wherein said buffering solution is present in a concentration of at least 0.01 mM.

51. A method according to claim 48, wherein the concentration of the buffering solution ranges from 0.1 to 100 mM.